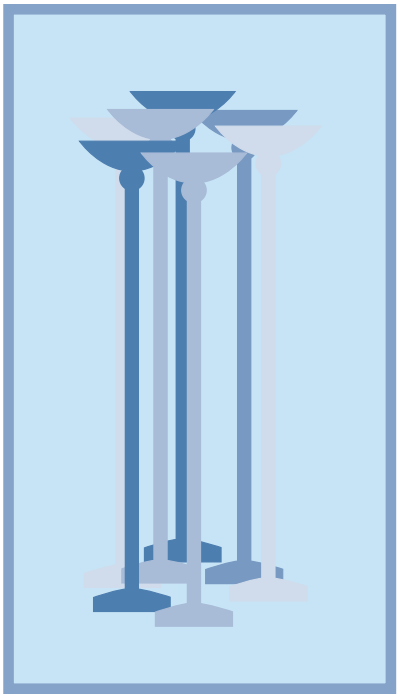
Federal Energy Management Program

DOE/EE-0262

Energy-Efficient Torchiere Swap Guide

Safety and Energy Concerns



Prepared by FEMP's New Technology Demonstration Program

Background of the CFL Torchiere

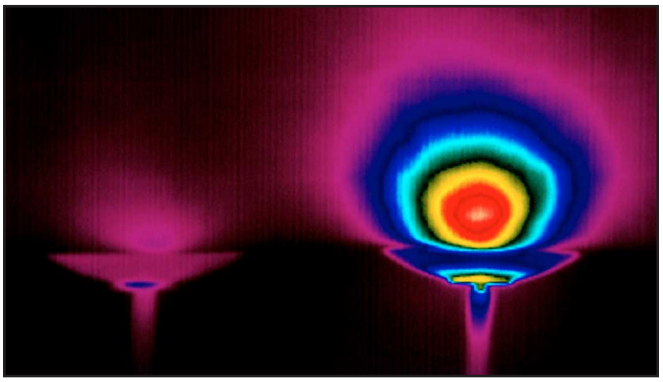
In 1996, the magnitude of the halogen torchiere (uplight) problem began to gain public attention. Estimates claimed that 15 to 20 million halogen torchieres were annually joining the United States' existing torchiere stock of 40 million. The energy conservation world soon discovered that this staggering proliferation of 300-watt torchieres represented a major step backward in energy efficiency.

When the Consumer Product Safety Commission (CPSC) reported that the hot halogen torchiere lamps were directly responsible for many fires and deaths, the intense media coverage placed the issue into consumer consciousness. Most recently, the number stood at 200 fires and 14 fire-related deaths. Market pressure for a safer alternative to the ubiquitous halogen torchiere grew as universities across the United States banned the luminaires, and the CPSC and Underwriters Laboratory reconsidered the safety of the torchieres.

Halogen technology uses similar scientific principles to the standard incandescent light bulb, except they are operated at a much higher temperature. The glass shield that covers halogen lamps often reaches temperatures as high as 700°F. Paper and cloth will both catch fire if they come in contact with temperatures this high. This presents a major safety concern to housing managers and residents.

Basic Torchiere Facts

- *Halogen torchieres burn at a much higher temperature than compact fluorescent torchieres.*
- *The Consumer Product Safety Commission (CPSC) declared halogens a fire hazard in 1996.*
- *Halogens use four times as much energy to produce the same amount of light as compact fluorescent lamp (CFL) torchieres.*
- *CFL torchieres are currently available in several home-improvement and office supply stores.*
- *most CFL torchieres pay for themselves in energy savings within 3 years (assumptions: $ .10kWh, 3 hours use per day, 300 watt halogen torchiere replaced by 60 watt CFL torchiere)*



Compare the heat profile of a halogen lamp (right) to a CFL (left)

Torchiere Facts Over Seven-Year Torchiere Life

	Typical Halogen Torchiere	Typical Compact Fluorescent Torchiere
Energy	300 watts	30-70 watts
Efficacy*	15 lpw	60 lpw
Energy Costs	$300	$55
Temp.	700°F	140°F
Initial Costs	$10-$50	$30-$100

**brightness coming off of the bulb per energy unit.*

The above table compares the energy and cost characteristics of a new CFL torchiere to those of the halogen. Note that the CFL efficacy is four times higher than the halogen efficacy.

As a result of the safety concerns and energy consumption problems with halogen torchieres, the Lawrence Berkeley National Laboratory (Berkeley Lab) began researching CFLs as a replacement option. A detailed analysis of halogen torchieres showed promise that the new CFL alternative would match or exceed the performance of halogens. A demonstration at Stanford University found that the average halogen lamp efficacy was approximately 12 lumens per watt (lpw), compared to 60 lpw for compact fluorescents. CFLs in the 50-to 70-watt range can achieve the same light output as halogen torchieres.

Conservation Potential and Cost Savings

Most of the energy produced in the United States is burned from coal, oil, or non-renewable resources. If we assume there is one halogen torchiere for every two of the 300,000 military housing units in the country, a typical penetration rate at the military bases we have seen, the military would reduce its fossil fuel use by more than 4500 tons of petroleum, or 7100 tons of coal annually.

In addition, energy that comes from coal or oil emits several environmental pollutants, including sulfur oxides (SO_x), nitrogen oxides (NO_x), and carbon dioxide (CO_2). Sulfur oxides are a major contributor to acid rain, which can run off into aquatic environments and affect available water supplies. NO_x and CO_2 are greenhouse gases that act as a thermal blanket over the earth. Heat that would normally escape is trapped in the atmosphere, keeping the earth unnaturally warm. By reducing energy consumption from using energy-efficient torchieres, military housing can reduce their SO_x emissions by approximately 3,000 tons and save more than 1500 tons of NO_x and 40,000 tons of CO_2 from entering the atmosphere each year.

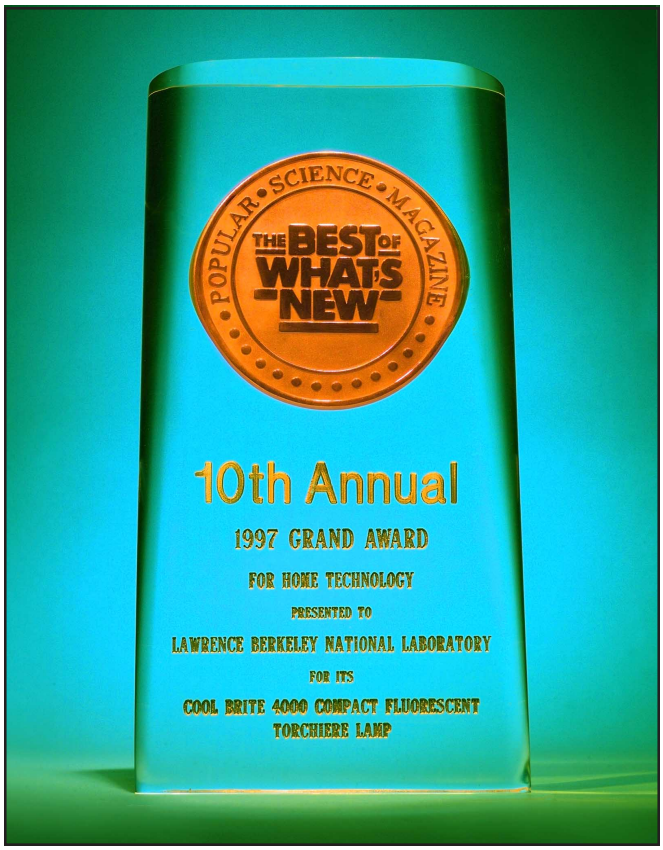
The average military base has the potential to save more than $6000 per year in energy costs and reduce pollutant emission rates by thousands of pounds each year.

Each household that swaps its 300-watt halogen for a CFL torchiere will save approximately $25

per year in energy costs and reduce their household energy load by 350 kWh.

However, before it is possible to reach these goals, the main challenge with energy-efficient products is getting them into the marketplace. A fast way to educate consumers and boost energy-efficient torchieres into the marketplace is with swap-out programs.

Assumptions: Energy cost = $0.10/kWh, housing units per base = 350, penetration rate = 50%, total number of military housing units in the United States = 300,000



Popular Science Magazine recognized Berkeley Lab's torchiere research in its 1997 "Best of What's New" edition. The magazine editors awarded Berkeley Lab with the Grand Award for Home Technology for their development of safe torchiere lighting.

Review of Residential Torchiere Programs

Collaborations between lighting researchers, the fixture industry, and housing communities have been established to organize the first high-profile demonstrations and implementation programs of this new CFL torchiere technology. Many of these demonstration sites have been interested in purchasing CFL torchieres, not only because of the safety issues, but also because the luminaires pay for themselves through energy savings, often within two years. Torchiere swap-out programs have successfully introduced energy-efficient torchieres to consumers, who have shown a high degree of acceptance.

Case Study #1: Halogen Torchiere Use in Military Housing: Bolling Air Force Base

Primary focus: Fire hazard from hot-burning halogen torchieres

In 1997, the Federal Energy Management Program (FEMP) sponsored a torchiere swap and demonstration at Bolling Air Force Base. This program was intended as both a technology showcase for newly commercialized energy-efficient torchieres, and as a scoping study to determine the energy savings potential that they offered to military housing installations. The base commander was particularly concerned with the safety hazard posed by halogen torchieres.

Project Scope

The Bolling Air Force Base program consisted of several steps, including:

1. Initial survey of residents: How many torchieres are there in housing units?
2. Follow up survey: Are residents willing to participate in a CFL torchiere monitoring study?
3. High profile swap event: Residents exchanged their halogen torchieres for CFL torchieres.
4. Data collection period: Newly installed CFL torchieres were monitored for usage statistics.
5. Final survey: What are residents' impressions of the CFL torchieres?

Bolling implemented a large swap-out program at the base with the full support of the base commander. At the swap, lighting monitors were installed on the lamps of the residents who agreed to participate in the study. Data from these monitors indicated that the average "on-time" per day was roughly three hours (**Figure 1**, see Case Study #2). Other studies have shown that torchieres are typically used between two and five hours per day, varying with seasonal changes in daylight. The lighting loggers also indicated that residents rarely used their lamps at a dimmed level, instead preferring to run them at full brightness.

The final surveys indicated that the residents were quite satisfied with the performance of the CFL torchieres. Eighty percent of the residents were either "very satisfied" or "satisfied." The most common complaint about the CFL torchiere was "not enough light," which was shared by 40% of the users. Over 90% of the users agreed that, "overall, the lighting was comfortable."

Main gate at Bolling Air Force Base, site of the 1997 torchiere swap and demonstration program.

At Bolling Air Force Base, there was a daycare facility that replaced 11 hot-burning halogen torchieres with the safe CFL torchieres. This swap-out not only brought safer light fixtures to the daycare center, it publicized the value of CFL torchieres to the participants' and others' households. In other swap programs, high-profile events have substantially expanded the household penetration of safe torchiere lighting.

Dr. Siminovitch (Berkeley Lab) assists with the Bolling Air Force Base torchiere swap-out.

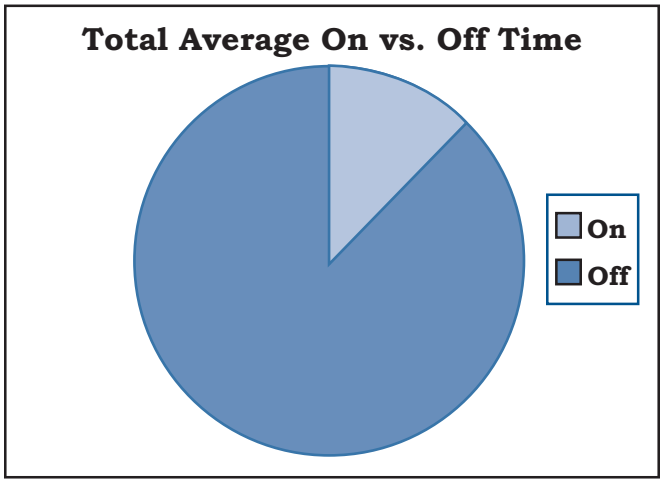


Figure 1: *At Bolling Air Force Base, torchieres were on roughly 3 hours per day.*

Case Study #2: Municipal Utility Torchiere Programs

Primary Focus: Energy conservation and peak time load shedding

Many utilities have conducted CFL torchiere rebate and swap programs to reduce their energy loads. Oftentimes they offer internal rebates with a torchiere distributor, such as a home improvement store. Internal rebates are rebates for the consumer that are worked out between the utility and the distributor. The fixtures are simply offered at a lower price to the consumer, and the distributor collects the rebate at the wholesale level.

One utility, the Sacramento Municipal Utility District (SMUD), held several successful torchiere programs in which thousands of participants in each program swapped their fixtures. To learn more about consumer preferences and compact fluorescent torchieres, they are currently collaborating with Berkeley Lab to conduct a residential torchiere study. The Lab and SMUD are investigating use patterns, the importance of dimming control to residential consumers, and large-scale energy saving potential.

The preliminary halogen torchiere data show that the majority of the SMUD households operated their torchieres one to three hours per day (**Figure 2**). However, the daily average was 3.7 hours because a small portion of households used their torchieres much longer. In the most extreme cases, some torchieres were left on for more than 11 hours daily!

Daily Hours On

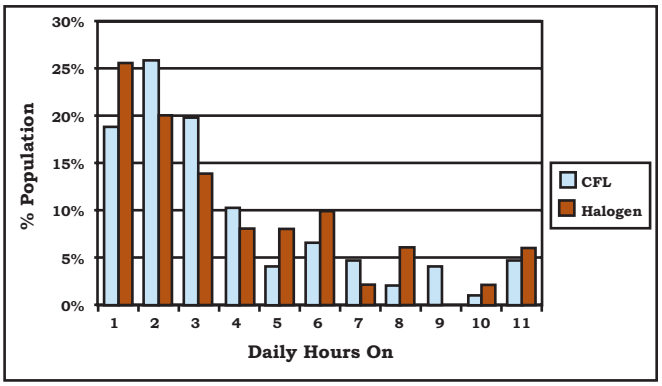


Figure 2: *Compare the difference between the energy used by halogen torchieres (pink) and CFL torchieres (blue). Halogen torchieres use approximately four times more energy.*

Time of Day

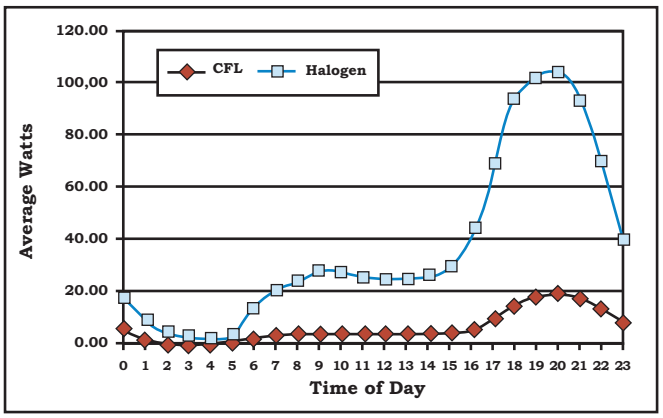


Figure 3: *While most households left their torchieres turned on for one to three hours per day, a small portion of people left their torchieres on for much longer.*

SMUD and Berkeley Lab also found that SMUD's torchieres were most commonly used in the evening hours from 7:00 to 9:00 pm (**Figure 3**). Time of day information will be useful for utility energy load management. If halogen torchieres are operated during peak hours, CFL torchieres

could present a viable solution to reduce these loads and decrease power costs.

Utilities have used torchiere swap programs successfully to get this new technology out into the residential sector. Thousands of households across the U.S. are enjoying safe, efficient CFL torchieres in their homes.

Utilities hold swap-outs to spread this new technology through the residential sector.

Case Study #3: Stanford University's Swap-Out

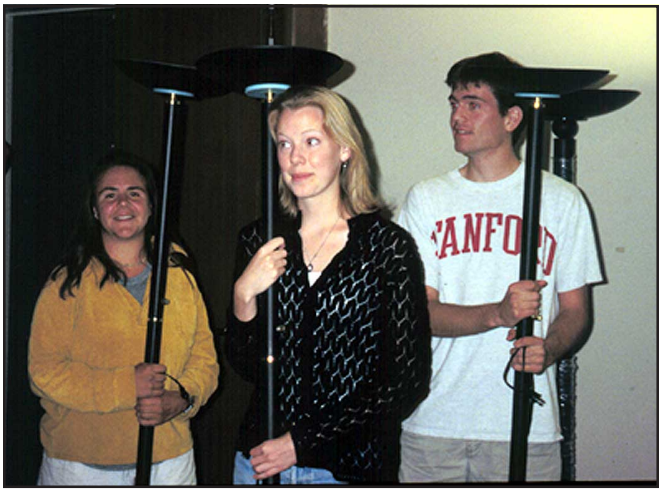
Primary focus: Fire safety and energy conservation

Stanford University's utility department collaborated with Berkeley Lab to conduct a dormitory torchiere swap-out. Stanford facilitated this program as a result of several incidents of fires nearly starting in student rooms, a desire to improve energy efficiency, and the need to provide an alternative to halogen torchieres, which were going to be banned the semester after the swap-out.

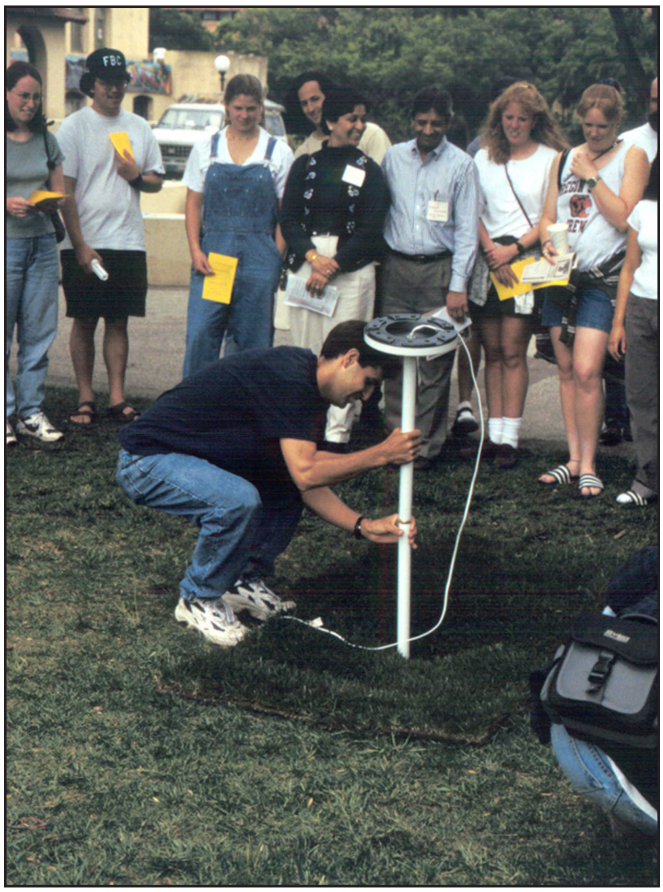
Stanford's program consisted of the following steps:

- a survey of the dorm buildings that was conducted during a regularly scheduled bi-annual walk-through inspection
- a series of public relations events
- posting fliers
- an educational ceremony during campus Earth Day festivities
- meetings and presentations with dormitory resident assistants
- swap-out events in the two dorm buildings with the highest concentration of halogen torchieres
- a follow-up swap by appointment for the first 500 students who called in
- CFL torchiere and replacement lamp sales in the campus bookstore.

Stanford students were accepting of this new technology, which was not even on the market at the time of their swap-out. Some students were hesitant at first, but after trying out the new luminaire, they realized the bright, high quality of light that they were getting was a good deal.

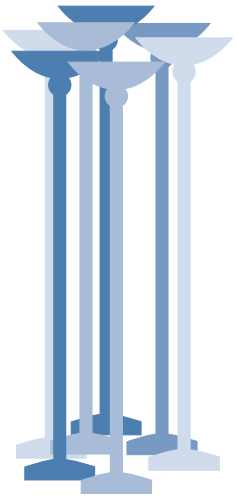


Students at Stanford University wait in line to trade in their halogen torchieres for CFLs.



In a lighter moment, Stanford students bury a halogen torchiere as part of their Earth Day celebration.

A student carries her new CFL torchiere back to her room.



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